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REMARKS

In the Office Action, the examiner objected to the specification because of the informalities. Accordingly, the applicant has amended the specification to correct the informalities. In this opportunity, the applicant has amended the specification to correct minor wording errors and to more clearly describe the features of the present invention. Also in this opportunity, the applicant has amended Figs. 1(b) and 1(c) to more clearly illustrate the shape of the cutting tool of the present invention to be consistent with the descriptions in the specification. This is to verify that no new matter has been introduced by this amendment.

The examiner rejected Claims 1, 2, 4, 7 and 8 under 35 U.S.C. 103(a) as being unpatentable over Shoemaker (U.S. Patent No. 1,781,863) in view of Simpson (U.S. Patent No. 5,853,268). The applicant has amended Claim 1 to more clearly differentiate the present invention from the technologies disclosed by the cited references. More specifically, the applicant has added the limitations "said semi-cylindrical body portion has a half-moon shape in cross section, and said cutting tool cuts the workpiece while being kept unrotated, and a rake angle of said rake face is 0° when cutting the workpiece" to Claim 1.

The limitation of "the semi-cylindrical body portion has a half-moon shape in cross section" is supported by the bottom view of Fig. 1(c) which shows a straight line (end cutting edge portion

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6) running the center of the circle (tapered end of the cylindrical shank portion 3). The limitation of "the cutting tool cuts the workpiece while being kept unrotated" is supported by the description in the specification, for example, in the paragraphs [0032] and [0038] and the drawing, for example, Fig. 7, which clearly show that the cutting tool 1 cuts the workpiece without rotation. The limitation of "the rake angle of the rake face is 0° when cutting the workpiece" is supported by the specification at the paragraphs [0032] and [0038] each of which indicates that the rake face 8 is always held perpendicular to the predetermined direction (moving direction), because, by definition, the rake angle is zero when the rake face is perpendicular to the moving direction, i.e., the rake face is parallel with a tool reference plane throughout the operation.

In summary, as defined in Claim 1 as amended, the essential features of the present invention reside in the fact that (1) the semi-cylindrical body portion has a half-moon shape in cross section, and (2) the cutting tool cuts the workpiece without rotation while the workpiece rotates in the predetermined direction, and (3) the rake angle of the rake face of the cutting tool is 0° when cutting the workpiece. These essential features of the present invention is not shown or suggested by the cited references as discussed below.

The cited Shoemaker reference discloses a rotary cutting tool to bore a clean hole in soft rubber (column 1, lines 22-23). The

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cutting edge 14 is a true arc of a circle of approximately 120 degrees (column 2, lines 67-78). The way of use of the tool is identical with the use of any rotary cutting tools, and thus, the cutting edges 14-18 being operated as and acting as cutting edges when the tool is rotated (column 3, lines 9-15).

It is apparent by the name "rotary cutting tool" and the description at column 3, lines 9-15 quoted above, the cutting tool of the cited Shoemaker reference rotates when cutting the workpiece. In contrast, as stated in the feature (2) and also by definition, the non-rotary cutting tool of the present invention will not rotate when cutting the workpiece, i.e., the principle of operation is different from that of the cited Shoemaker reference. Therefore, the cited Shoemaker reference does not show or suggest the feature (2) of the present invention.

Further, the cutting edge 14 disclosed by the cited Shoemaker reference is shaped as a true arc of the circle which extends approximately 120 degrees along the circle. In other words, the cutting edge 14 is a thin edge suitable for cutting a sheet of soft material such as soft rubber in which high rigidity and durability is not required for the cutting edge. Since the cutting edge 14 does not require to have high rigidity and durability, such a shape of the true arc is appropriate for the practical use.

In contrast, in the present invention, as stated in the feature (1) above, the semi-cylindrical body portion (cutting edge) has the half-moon shape in cross section. Because the cutting tool

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of the present invention is used in the machining process for cutting the hard material to form the scroll members 100, 103, very high rigidity and durability is required for the cutting edge. Such high rigidity and durability is achieved by the half-moon cross sectional shape of the semi-cylindrical body portion because the half-moon shape has a sufficient thickness which is a half of the diameter of the tapered end of the cylindrical shank portion. Therefore, the cited Shoemaker reference does not show or suggest the half-moon shape stated in the feature (1) of the present invention.

As stated in the feature (3) above, the rake angle of the rake face of the cutting tool is  $0^\circ$  when cutting the workpiece. Since the cutting tool 1 is not rotated in the machining operation, and the rake angle during the machining operation is  $0^\circ$ , the machined workpiece (scroll member) has a higher degree of accuracy than where it is machined by a conventional rotary cutting tool such as an end mill which is likely to suffer from its run out. Thus, it is possible to obtain a higher degree of fluid tightness between scroll walls of the respective scroll members.

The cited Shoemaker reference is completely silent about the rake angle of the cutting tool. As discussed above, because the cutting tool disclosed by the cited Shoemaker reference is rotated when cutting the workpiece, and the workpiece is soft rubber, there may not be any significance in the rake angle for the operation of the cutting tool. At any rate, nowhere in the cited Shoemaker

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reference does it mention about rake angle or any angle involved in the cutting tool, thus, Shoemaker does not show or suggest the feature (3) of the present invention.

The cited Simpson reference discloses a method of producing a diamond-coated insert (cutting point). The method includes the steps of coating a diamond layer onto a smooth surface of a substrate of durable material, and partitioning the diamond coated substrate into multiple inserts having desired geometry with use of a laser beam. Although the cited Simpson reference shows the idea of coating the diamond on the cutting edge, none of the essential features (1)-(3) of the present invention noted above are shown or suggested by this reference.

As shown in Fig. 1, the cutting tool (insert) of Simpson is a rotary cutting tool which is attached to the toolholder 104 which rotates about its axis. It should be noted that although the cited Simpson reference includes statements regarding the rake face angle at column 4, lines 45-49, this statement is directed to the angle of the laser beam for cutting the diamond coated substrate. Thus, it is unrelated to the rake angle of the rake face of the non-rotary cutting tool of the present invention.

As discussed above, since none of the essential features of the present invention are shown or suggested by the cited Shoemaker reference or the cited Simpson reference, the present invention defined in Claim 1 is not obvious over the cited references taken singly or in combination. Thus, the applicant believes that the

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rejection under 35 U.S.C. 103(a) is no longer applicable to the present invention. Since Claims 2-8 are dependent upon Claim 1 as amended, the inventions defined in Claims 2-8 include all of the limitation of Claim 1 in addition to further specificities. Because the invention of Claim 1 is patentable as discussed above, the inventions of Claims 2-8 are patentable as well.

In view of the foregoing, the applicant believes that Claims 1-8 are in condition for allowance, and accordingly, the applicant respectfully requests that the present application be allowed and passed to issue.

Respectfully submitted,  
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**IN THE DRAWING:**

The applicant has submitted concurrently herewith a request for approval of drawing changes in which reference characters are added to Figs. 1(b) and 1(c) to more clearly describe the shape of the cutting tool.



**FIG.1**

